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SYNERGETIC MANAGEMENT OF COMPLEX MILITARY SYSTEMS

Milton V. Ratynski

May 1966

ELECTRONIC SYSTEMS DIVISION

TECHNICAL REQUIREMENTS AND STANDARDS OFFICE
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AIR FORCE SYSTEMS COMMAND
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FOREWORD

Information contained in this document was presented by the author and published in the 1966 IEEE International Convention Record, March 21-25, 1966.

REVIEW AND APPROVAL

This technical report has been reviewed and is approved.

FRANK E. BRANDEBERRY, Colonel, USAF
Chief, Technical Requirements
and Standards Office

ABSTRACT

This paper highlights the organization of a creative technology--System Engineering Management. A new Air Force Systems Command Manual[1] describes the importance of TOTAL SYSTEM DESIGN, in which it is recognized that the successful design of a complex military system is fundamentally dependent upon the complementary interplay between all the technical/managerial/support specialists and disciplines. The procedures summarized herein are the engineering management standard for all future system acquisition programs and projects by the Air Force.

SECTION I

INTRODUCTION

In recent years, increasingly complex military systems have been designed and developed. During this time, there has been an emerging awareness of the need for and the importance of TOTAL SYSTEM DESIGN. Groups of specialists emphasizing reliability, maintainability, facilities, safety, human performance, system testing, etc., have forced a recognition that a system does not consist of equipment alone.

The word "system" has come, through practice, to include: prime mission equipment; computer programs; equipment for training, checkout, test, and maintenance; facilities required to operate and maintain the system; selection and training of personnel; operational and maintenance procedures; instrumentation and data reduction for test and evaluation; special activation and acceptance programs; and logistics support for test, activation, and operational aspects of the program.

All parts of a system must be synergetic and have a common unified purpose. This absolute necessity for coherence requires an organization of creative technology which can lead to the successful design of a complex military system. This organized creative technology is termed by the Air Force as System Engineering Management. System Engineering encompasses and thus replaces terms such as: systems approach, systems analysis, system integration, functional analysis, system requirements analysis, reliability analysis, task analysis, maintenance analysis, system definition, and team development method.

System Engineering Management is fundamentally concerned with deriving a coherent **total** system design to achieve stated objectives and recognizes the predominent and highly complementary role played by engineering design specialists in satisfying total system design requirements and the interplay between the system engineers and the engineering design specialists.

System engineering per se is not new, however, the formalizing and standardizing by the Air Force upon a particular approach is new. Industry and government organizations will have ample opportunity to become intimately familiar with the AFSCM 375-5 concept, as new contracts are awarded. In this short paper, it will be possible only to introduce the scope, describe the concept, and hopefully, to encourage a much more thorough study by the reader.

SECTION II

THE AIR FORCE SYSTEM LIFE CYCLE

The primary purpose of this paper is to highlight the Air Force system engineering management technique, however, there is an overall, master management technique that will be briefly described first, the Air Force 375 System Management Technique.[2]

Air Force Systems Command Manual AFSCM 375-4, "System Program Management Manual," describes the details,the activities and events that new Air Force systems will be required to establish and to be subject to during the life cycle of the system. The total life cycle of a system program is divided into four phases--conceptual, definition, acquisition, and operational. The overview in Figure I provides a context within which specific elements may be placed.

The Conceptual Phase

The most important objective of the conceptual phase is to develop total system and program requirements from a broad system objective or mission. These requirements serve as the technical, economic, and military basis necessary for a decision to develop the system and as the technical and management inputs for contract statements of work and for the system design process.

CONCEPTUAL PHASE

Feasibility Studies
SPO Cadre established
Preliminary Technical Development Plan prepared
System Objectives developed
Trade-Off Analysis
Technical Approach established

DEFINITION PHASE

SPO established
Definition Contractor(s) selected
System design specifications developed
Design trade-offs
Specific approach selected
Mgmt plans developed

ACQUISITION PHASE

Development/Engineering Contract awarded
Detail designs completed
Logistics/support plans activated
Equipments produced
Engineering Inspections/ Cat I, II Tests Conducted

First Operating Unit Accepted →

← Last Article Delivered

OPERATIONAL PHASE

Category III tests conducted
Necessary re-designs initiated
Maintenance, logistics, support actions completed
System turned over to user or modified, as required

Figure 1

New Air Force System Life Cycle

The conceptual phase is generally accomplished in-house by DOD, Air Force, and the Systems Division concerned, although, on occasion, preliminary system design studies are awarded to industry. The not-for-profits are also active at this point in time assisting in the development of detailed objectives, performing major trade-off studies, and development of the preliminary plans for higher headquarters review and approvals.

Before a system may enter into the Project Definition Phase, the following seven prerequisites must be satisfied.

- Engineering (not experimental) effort is required.
- Technology & building block components are in hand.
- A thorough trade-off analysis is completed.
- The best technical approach is selected.
- Mission and performance are defined and optimized for technical feasibility and cost effectiveness.
- Cost and schedule estimates are credible.
- Cost effectiveness of the proposed system is favorable over other DOD dollar competition.

The Definition Phase

The issuance of a system definition directive by Hq USAF signifies the start of the definition phase.

Department of Defense Directive 3200.9[3] states:

"The most important objective of the Definition Phase is to provide an adequate basis to assure that management decisions to proceed with, cancel,

or change development projects are made on a total system and total cost basis. This basis should include realistic cost and schedule estimates and achievable performance specifications backed, in the case of contractor-conducted Project Definition, by a firm fixed-price or fully structured incentive proposal for the Acquisition Phase."

The definition phase is normally conducted on a fixed-price basis by two or more competitive contractors. The competition is to be in terms of system concept, design approach (including solutions to major trade-offs), technical and management planning, and overall cost and schedule. The winning contractor will normally be awarded the full scale development contract. The definition phase, therefore, is the period preceding full scale development during which system engineering and technical management planning for acquisition are accomplished.

The Acquisition Phase

This is the period during which the detailed engineering is accomplished, the equipment is fabricated, and technical validations are made to determine whether the contractor has met specification requirements. The acquisition contractor is required to perform in accordance with the system performance and the end item detailed specifications that were developed during the definition phase.

The acquisition phase is also the direct opportunity for the "customer" (the using agency) to participate in those tests and evaluations and decide whether he, the "customer" will accept the first operating units for operational use.

Air Force Systems Command Management Manuals

The AFSC Manuals are the medium through which Air Force directives, regulations, dictums and requirements are put into practice. There is a master scheme and a specific usage for each manual, in that some are intended for Air Force usage only, while others are applied selectively as required on specific contracts. Figure No. 2 summarizes those of prime interest to industry. The manuals are all cross-referenced extensively in order to eliminate conflicts and double standards. Additional information relative to those manuals that have a major impact upon contractors follows.

AFSCM 375-3, System Program Office Manual

375-3 describes what a SPO is, how it is organized, how the overall job is done, the general responsibilities, the relationships with other government agencies, and the functional duties and responsibilities of all the members of a SPO. 375-3 is introductory and indoctrinational in nature and will never be applied on a contract as a requirement, but is of useful interest to contractors.

AFSCM 375-4, System Program Management Procedures

375-4 establishes the requirements, policies, and procedures for the Conceptual, Definition, Acquisition, and Operational Phases of a system program. It prescribes the significant management activities for integrating and fulfilling the responsibilities of the organizational elements involved in managing a system program. It is the mandatory management standard for all future Systems Command system programs and projects. AFSCM 375-4 will

NO.	TITLE	DATE OF ISSUE	FOR CONTRACT APPLICATION	REMARKS
375-1	CONFIGURATION MANAGEMENT DURING DEFINITION AND ACQUISITION PHASES	1 Jun 64 Currently being revised	Yes	Applies to all Hardware and Software procurements
375-2	SYSTEM PROGRAM MANAGEMENT SURVEYS AND INDUSTRIAL MANAGEMENT ACCOUNTING SURVEY	Not listed in July 65 Index.	No	Used by IGs and survey teams.
375-3	SYSTEM PROGRAM OFFICE MANUAL	15 Jun 64	No	Chatty discussion of how a SPO operates.
375-4	SYSTEMS PROGRAM MANAGEMENT MANUAL	Definition Phase 16 Mar 64 Currently being revised and expanded	No	Phase Manual - 5 appendices covering each Division of SPO. (flow chart and narrative)
375-5	SYSTEM ENGINEERING MANAGEMENT PROCEDURES	Interim issue 14 Dec 64 Final issue in printers	Yes	Exhibits to be followed literally; rest of text is guidance and philosophy
375-6	DEVELOPMENT ENGINEERING	14 Aug 64	No	Bible of CMD (DCASR) personnel.
375-?	SYSTEM TRAINING EQUIPMENT MANAGEMENT	Final draft being reviewed	Yes	Used by Personnel Subsystem managers and Air Training Command
310-1	MANAGEMENT OF CONTRACTOR DATA AND REPORTS	15 Mar 64	Yes	Vol I - Policies and Responsibilities Vol II - Authorized (standardized) Data List Used on all procurements requiring data (documentation) from contractors
70-?	PREPARATION OF WORK STATEMENTS	Final draft being coordinated		Model Work Statements. Each AFSC Division may prepare a supplement to this manual.

Figure 2

System Management Manuals

AFSCM 375/310 Series

never be placed on contract as a contractual requirement, however, it is vital for oontractors to be familiar with 375-4, since this is the "roadmap" of management and technical milestones and events that a SPO will follow on all future contracts. AFSCM 375-4 is the "overall" AF systems management manual and references 375-1 and 375-5.

AFSCM 375-1, Configuration Management Manual

AFSCM 375-1 establishes the policy, guidance and the responsibilities for system/equipment in the management of the configuration of systems/equipments. It prescribes the format the details for preparation and maintenance of specifications and drawings. It provides for the control and approval of engineering changes and for implementing these decisions. It describes the various engineering inspections and compliance reviews. AFSCM 375-1 is placed on contracts as a contractual requirement on a selective Exhibit by Exhibit basis.

AFSCM 310-1, Data Management Manual

Describes the overall data (documentation) management approach, control procedures and standards. 310-1 is also a catalog of approved data (documentation) items. Air Force organizations ordering data from contractors choose their documentation required from this approved list. Selective portions of AFSCM 310-1 are placed on all contracts.

AFSCM 375-5, System Engineering Management Procedures

This is the manual being described in this paper. AFSCM 375-5 is placed on contract and becomes a contractual requirement, selectively, on an Exhibit by Exhibit basis.

SECTION III

UNIFORM DESIGN PROCESS

No two systems are ever alike in their developmental requirements. However, there is a uniform and identifiable process for logically arriving at system decisions regardless of system purpose, size, or complexity. AFSCM 375-5 describes and specifies such a process, i.e., a system engineering management process. The generation of a balanced system design requires that each major design decision be based upon the proper consideration of system variables such as: facilities, equipment, computer programs, personnel, procedural data, training, logistics, intrasystems and intersystem relationships. All considerations must be made within the parameters of time, cost, and performance as defined or developed for the system. This logical consideration, evaluation, and selection of a balanced system design necessitates the closest coordination of selected skilled personnel who work as a homogenous system engineering design team. The 375-5 system engineer uses methodology all engineers use, but does use more analytical reasoning and attacks problems all at once, rather than piecemeal. Additionally, the system engineer draws on a wider experience and a point of view that recognizes functional similarities. This then enables the organization of engineering contributions.

Organization of AFSC Manual 375-5

The 375-5 manual establishes and describes in detail the Air Force methodology for accomplishing the system engineering management process.

The main body of the manual provides guidance and policy for Air Force organizations and also is very useful to contractors for general information, and an understanding of how the government will manage system engineering.

The prime interest to contractors is in the four exhibits, any one or all of which may be placed on contract as a specific contractual requirement:

Exhibit I describes the milestones and events that should occur during a total, typical system engineering exercise.

Exhibit II describes in detail the documentation (data) that must be prepared by the contractor.

Exhibit III is used only on major programs and presents a method for conducting the analysis of maintenance functions utilizing automated maintenance documentation.

Exhibit IV details the responsibilities of the contractor, the government, and the not-for-profits during a system engineering management exercise.

The 375-5 manual incorporates the requirements of the following documents:

MIL-D-9310B (USAF) Data for Aeronautical Weapon Systems and Support Systems.

MIL-W-9411A (USAF) Weapon Systems, Aeronautical General Specification for

MIL-D-9412D (USAF) Data for Aerospace Ground Equipment (AGE)

SECTION IV

FUNDAMENTAL CYCLE OF THE SYSTEM ENGINEERING PROCESS

The cycle shown pictorially in Figure 3 describes the four fundamental steps in the AFSCM 375-5 system engineering process. The process is a tool for designing the system on a total basis so that the design will reflect considerations of requirements for equipment, computer programs, facilities, procedural data, and personnel in an integrated fashion. It provides the source requirement data for the development of specifications, test plans, and procedures; and the backup data required to define, contract, design, develop, produce, install, checkout, and test the system.

The system engineering process identifies: (1) AF system objectives, (2) the "design to" requirements necessary to meet these objectives, (3) the "build to" requirements which prescribe the ultimate configuration of the system to be delivered to the user, and (4) the requirements for personnel, training, procedural data, and logistics support. System engineering is initiated in the latter part of the Conceptual Phase, through the Definition and Acquisition Phases, and early into the Operational Phase of the 375-4 system life cycle described earlier.

The two fundamental purposes of the system engineering management process are: (1) to establish a single analysis, the definition, the trade-off, and the synthesis of requirements and (2) to provide a clear and concise reference source for selected system design solutions, for common

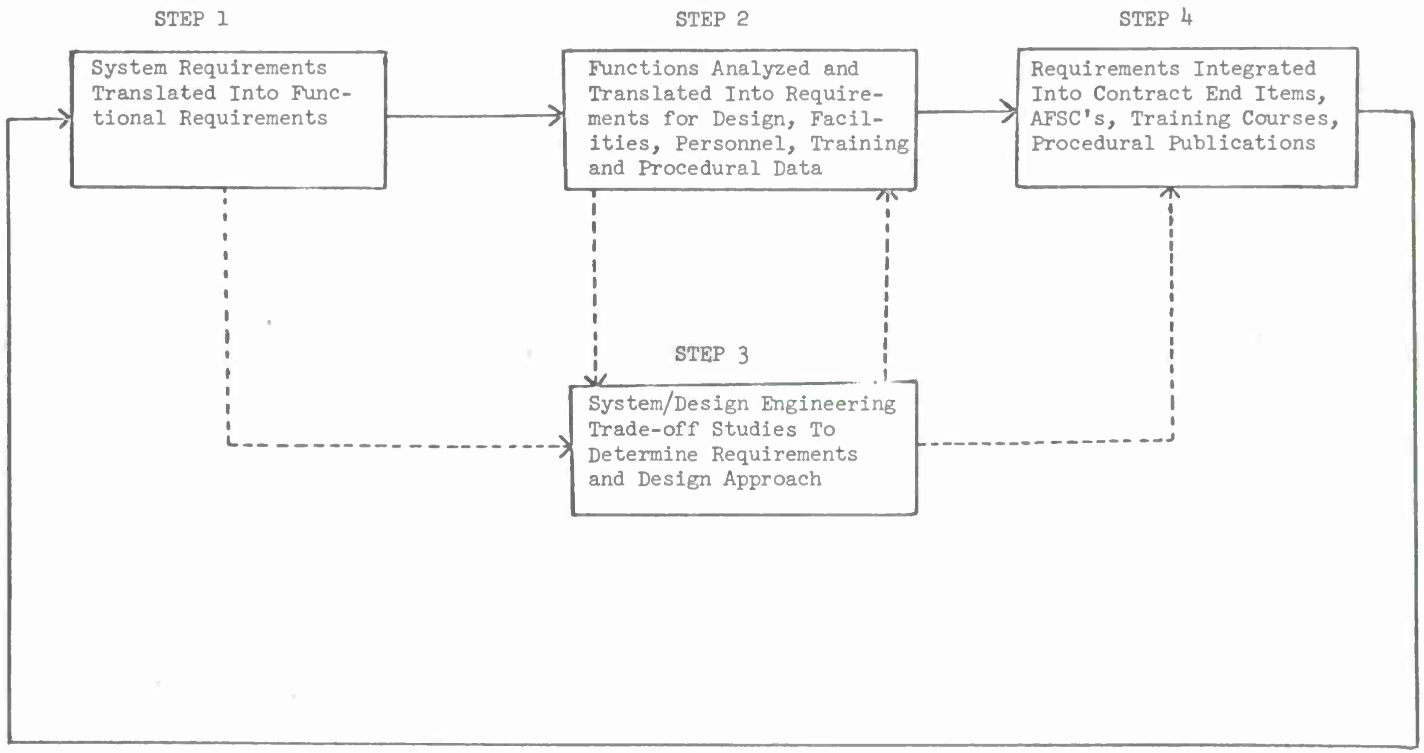

Figure 3

Fundamental Cycle of the System Engineering Process

use by the various AF organizations, between the AF and the contractors, and between contractor organizations. The single reference source will be evolved in consonance with the design process and will be the basis for the identification, control, and accounting of the system by means of configuration management procedures specified in AFSCM 375-1.[4]

Step One

The first step of the AFSCM 375-5 process, shown pictorially in Figure 3, is begun by either the Air Force or with the help of a not-for-profit contractor, and consists essentially of translating the military requirements into basic functional/technical requirements. These written requirements are then presented in a pictorial form identified as Functional Flow Block Diagrams and are useful in portraying the sequential and parallel interactions of functions. At this point hardware, circuits, or devices are not mentioned, the significant characteristic is a functional design.

Examples of a top level Functional Diagram for an electronic system might be:

(1) Detect and track all space objects within defined zone of apprehension.

(2) Identify mission of each object, compute apparent track and target, compose and dispatch warning messages and information concerning available protective measures.

(3) Display continuous status of space objects and defensive weapons and provide display of other pertinent data when called for.

The above is an example of gross "operations functions" which then would be supported by "maintenance functions," "test and activation" functions, and "production" functions. Once the gross functions have been evolved, accepted by the Air Force as appropriate, the system requirements can now be translated into sub-functions, which are the next level of expansion of the system functions.

The format, editorial style, and the standardized visual presentation of these top and first level Functional Flow Block Diagrams is detailed in AFSCM 375-5. The basic objective of these diagrams is to develop a first hypothesis for helping to mold the eventual solution. They are also important in accomplishing interfaces between contractors, since diagrams are essentially drawings to be approved and released internally within a contractor's facility in the same manner as engineering drawings.

<u>Step Two</u>

The second step of the AFSCM 375-5 process is to translate the functions detailed in the Flow Block diagrams into design requirements. The design requirements are those such as input, output, tolerances, safety, maintainability, reliability, etc., that provide the criteria for:

a. designing equipment and/or computer programs

b. defining equipment facility

c. defining intersystem interfaces

d. determining requirements for personnel, training, training equipment, and procedural data.

The design requirements at this time are officially and formally recorded on Requirements Allocation Sheets, as shown in Figure 4. The specific instructions for these sheets are described in detail in AFSCM 375-5. In essence, the completed Requirements Allocation Sheets will provide the "what" and "why" of every function, answering the questions: Why is the function necessary? Why should the functions be accomplished at this point in the sequence of activities? What engineering characteristics of this function are related to engineering characteristics of another function?

Step Three

The third fundamental step shown in Figure 3 consists of system/design engineering studies which are performed concurrently with Step 2 and Step 4 to:

a. determine the selection of alternate functions and functions sequence

b. determine the design, personnel, training, and procedural data requirements imposed by the functions

c. determine the best way to satisfy the design requirements, and

d. select the best design approach for integrating the design requirements into the various hardware items of equipment and/or computer programs

Step 3 permits the design approach to be detailed to the point necessary to satisfy the requirements that were listed on the Requirements Allocation Sheets (Step 2). Trade-off studies are now effected and are recorded in Trade Study Reports (format and content detailed in AFSCM

REQUIREMENTS ALLOCATION SHEET	Functional Diagram Title & No.________ ________________or Nomenclature & No. of CEI________ ________________(A)		Equipment (E) Identification		PERSONNEL AND TRAINING EQUIPMENT REQUIREMENTS (F)				Procedural Data Requirements (G)
Function Name & No (B)	Design Requirements (C)	Facility Requirements (D)	Nomen-clature (E1)	CEI or Detail Spec or Index or Master Control Nr. (E2)	Tasks (F1)	Time Req (F2)	Perform. Reqmts (F3)	Tng & Tng Equip Req (F4)	

Revision__________ Date________________ Approval____________ Document No.________ Page No.__ Of__

Figure 4

Requirements Allocation Sheet

375-5). Trade Study Reports contain, as a minimum, extracts from designer's notebooks, contractors internal memorandums, minutes of meetings, reductions of charts and formal engineering reports, etc. Study reports contain possible design approaches, the identification of significant design characteristics of each design approach, the impact of the design on cost, reliability, maintainability, personnel, etc., comparison of design approaches. Finally, there will be selection of a design approach with substantiation for the choice. The reasons will be in the form of Schematic Diagrams, outline drawings, interface details, reliability data, and other backup data.

Step Four

The primary activity in this step is the development of a Design Sheet (per AFSCM 375-5) which will define sufficiently detailed engineering information utilizing numerical values (quantitative reliability requirements for example) with associated tolerances to provide criteria for the detail design, development and test of the contract end items. The Design Sheet documents the "design to" and "test to" requirements and subsequently becomes part of the Detail Specification (AFSCM 375-1).

SECTION V

ITERATION OF THE SYSTEM ENGINEERING PROCESS

Having completed the fundamental cycle of the system engineering process, and upon documenting the results in "top" and "first" level Functional Flow Block Diagrams, Requirements Allocation Sheets, Trade Study Reports, and Design Sheets, the second level functions are identified and the fundamental process is repeated. The same procedure is repeated at any additional levels required to define and design the system. Some functions may not require separate diagram levels and may be included in a higher level diagram. There are interactions and feedbacks between levels as the cycle is repeated. Detailed examples are provided in AFSCM 375-5.

SECTION VI

IMPLEMENTING SYSTEM ENGINEERING MANAGEMENT

Industry-Air Force Guidance

Step-by-step procedures that are to be followed by both the SPO and the contractor are described in Exhibit I of AFSCM 375-5. These procedures essentially consist of a detailed flow chart which identifies the sequential activities on a relative time basis, beginning with the issuance of the Hq USAF requirement and extending through the early part of the Operational Phase. This diagram portrays the system engineering activities to be accomplished by the Air Force System Program Office, the contractors, and the not-for-profits (MITRE Corp., Aerospace Corp., System Development Corp., etc.). The activity diagram also identifies the required system engineering documentation and prescribes the relationships between documentation, engineering, design reviews, specifications, design baselines, and the major commitment points. This is the first time that a formalized detailed roadmap of engineering management activities has been provided to contractors. Formal points for Air Force management review of the system as it is being defined, designed, and developed are provided.

The Activity Flow Diagram

The activity diagram is highly detailed and portrays 106 activities that would normally be performed by the Air Force and the contractors. In

some instances, selective use of only those activities considered necessary to a particular program would be imposed on contractors, however, the 106 activities might conceivably be increased as well. Figure 5 portrays a small section of the system engineering activity flow diagram. It will be noted that the square blocks are primarily government responsibilities, while the octagonal blocks are primarily contractor responsibility. The flow shows a Specification Line, a System Design Line, and Operations Design Line, a Maintenance Design Line, and a Test Support Line with each line showing the major interacting activities required in conducting system engineering. It is possible, as an example, to go from left to right and follow the entire gamut of specification activities and note their relative time sequence to all the other activities. The circled numbers appearing below each block identify the documentation associated with the block. There is a continual interaction between lines of activities and, while the activities appear as step functions, they are in fact points on a continuum.

System Engineering Documentation

As recently stated by General B. Schriever,[5] "Decisions are the basis of management and data (documentation) are the basis of all decisions."

The identification, definition, and specification of the system engineering effort and the system requirements is accomplished on a progressive and formalized basis. Documentation is the basis and the product of the design effort. AFSCM 375-5 (and AFSCM 310-1) establishes detail documentation procedures that insure effective utilization in accomplishing design reviews,

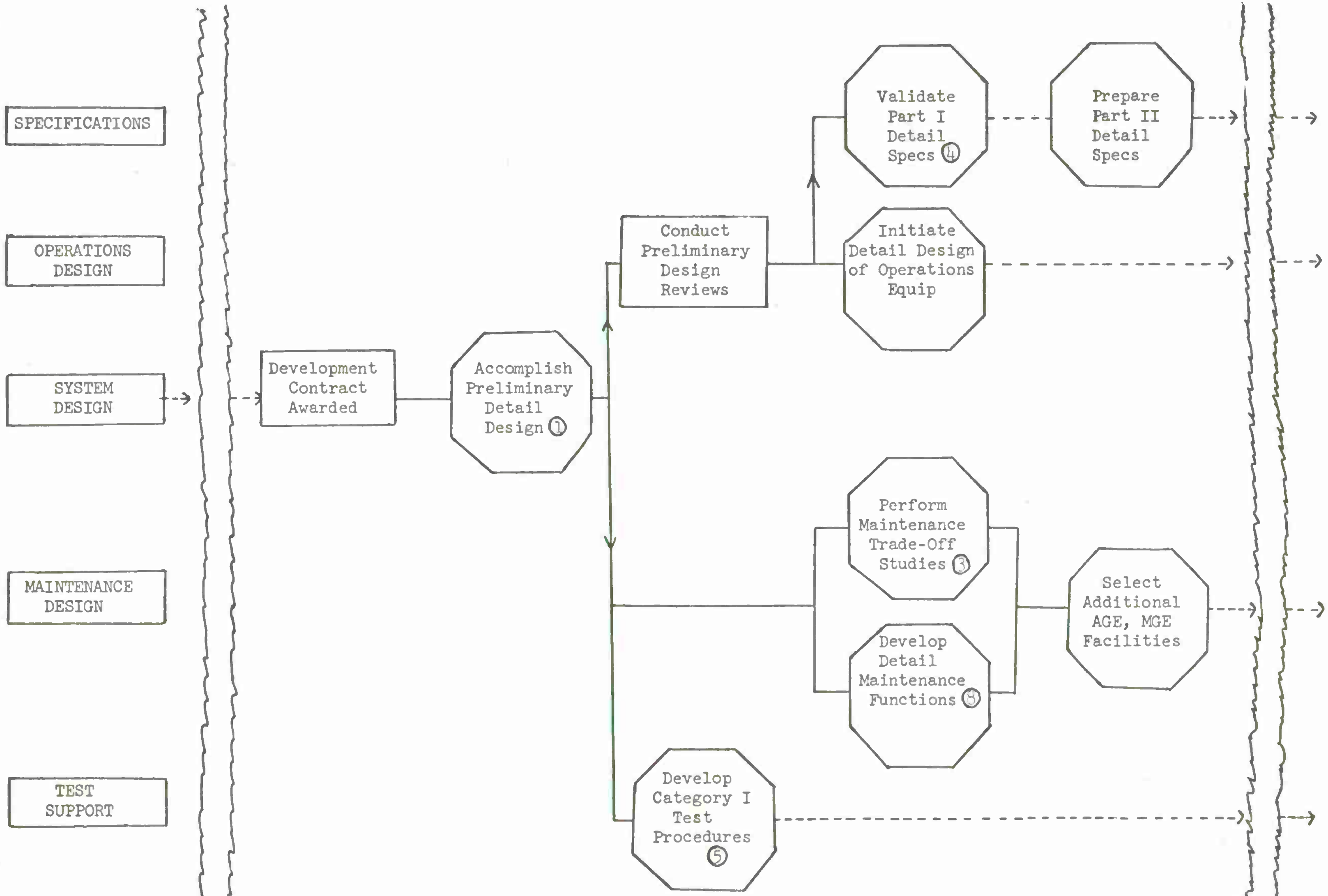

Figure 5

Portion of the System Engineering Activity Flow Diagram (as Described in AFSCM 375-5)

making engineering decisions, for developing specifications and drawings, for controlling changes, for making management decisions, and to insure logistics and maintenance compatibility.

As was earlier described, Design Sheets, Functional Flow Block Diagrams, Requirements Allocation Sheets and Trade Study Reports are utilized in the 375-5 process to serve as the basic documentation against which engineering evaluations during the Definition Phase are accomplished. Much of this data is incorporated into Detail Specifications which are then used as the basis for conducting the engineering inspections during the Acquisition Phase. Additionally, this data is used by the PERT/Cost activities, for procurement action, and as the basis for test planning.

Of prime importance is the development of logistics support requirements for the program. The data of particular use here is prepared as End Item Loading Documentation. It is vital that reaction times, maintenance down-time, and maintenance functions be considered in determining design requirements and selecting the design approach. Personnel Utilization Sheets, as an example, identify the maintenance personnel effort by specific maintenance location.

AFSCM 375-5 specifies, details, and furnishes the format for an imposing array of documentation. The objective is to insure a formatized and formalized control of the total system engineering effort. However, the use of system engineering documentation will vary upon the specific nature of a system or project. AFSCM 375-5 describes the

minimum documentation, however, the total extent of maximum documentation is subject to agreement between the AF and the contractor and will vary depending on the procurement requirement.

Comparison of Industry & Government Approach

The difference between past industry practice and the 375-5 requirements is primarily the degree of formalization within a logically developed framework. With 375-5, the main elements are laid out in advance so that they are understood not only by the contractor with respect to the job, but the customer as well. It is essentially an agreement between the two parties who have engaged in the contract as to what they expect to get, in considerable detail, at a fairly early point in time. This agreement--and its controls--is progressively definitized as the system is defined. Then there is a demonstration, as the equipment evolves, to show that the contractor has in fact achieved what was agreed upon. It will then be possible to look at the dollars, to look at the schedule, and by proper testing determine whether the contractor has been successful in producing the product that was intended. With some of the past systems programs, this was done but not in the same formalized manner. One reason, in part, was that the contractor was delving in an area where he wasn't certain of the end results, and the customer was never too certain of the operational use of the device after he received it. The customer frequently did not establish the specific philosophy of operation and maintenance until after the system was developed. Consequently, many changes occurred in

order to satisfy the basic operational requirements. In the past several years, both contractors and customers alike have gained considerable experience and this experience is now being reflected in Air Force regulations and manuals.

In order for the contractor to be totally responsive to the Air Force, the contractors organization should in effect parallel the customers organization. The contractors project manager would have a group of deputies reporting to him, covering essentially the same areas as the five deputies reporting to the Air Force System Program Office (SPO) director. The only area difficult to mirror is production.

Organization for System Engineering Management

Figure No. 6 shows the typical AF System Program Office organization and the overall relationship of the various system management manuals. This is the type of organizational structure that some contractors utilize and that would best assure compatibility with the SPO organization.

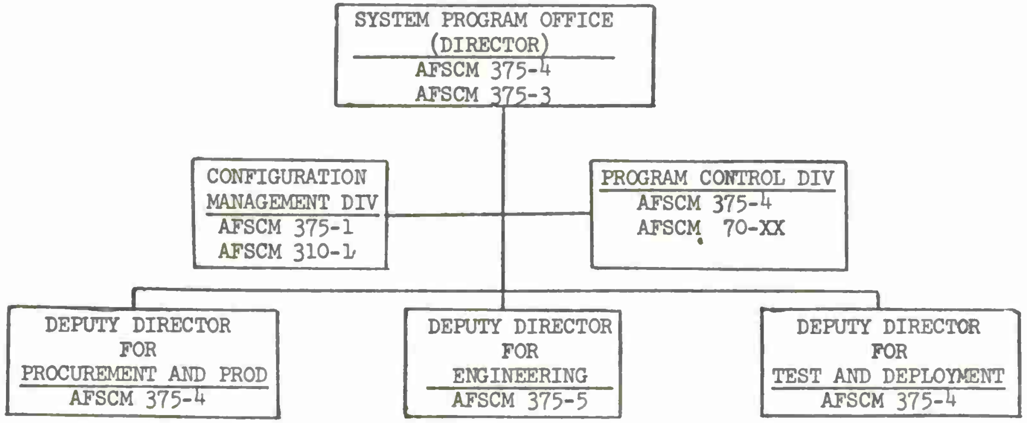

Figure 6

System Program Office Organization and the Overall Relationship to the AFSC Systems Management Manuals

SECTION VII

SUMMARY OF SYSTEM ENGINEERING PROCESS

AFSCM 375-5 establishes the requirements for step-by-step procedures to be followed in implementing system engineering management during the latter part of the Conceptual Phase, through the Definition and Acquisition Phases, and the early part of the Operational Phase. It specifies the required system engineering documentation and prescribes the relationships between documentation, engineering, design reviews, specifications, baselines and major commitment points.

The 375-5 manual has for the first time developed a sequential activity diagram on a relative time phase base beginning with the issuance of military requirements and extending into the Operational Phase. This diagram portrays system engineering activities to be accomplished by the military agency, the not-for-profits, and the contractors.

The new Air Force System Engineering Management Process significantly affects the policy, technical, and management procedures and practices under which all future systems will be acquired. This process integrates all of the technical and support disciplines into a total engineering process.

System Engineering will specify the hardware, the computer programs, facilities, personnel, training, and the procedural data required to meet AF system mission requirements. The objective is to get a job done that is technically correct, at minimum cost, and within the scheduled time period.

375-5 system engineering management is a technique that establishes a plan and enables the system manager to know where he stands with regard to that plan. The entire 375-5 concept is to define a task, determine a course of action, make available the tools to properly carry out that course of action, act, monitor, and respond accordingly.

"System Engineering Management has evolved into a corporate tool, as essential as any facet of technology. It is intended to eliminate fumbling and mistakes--remove the need for putting out unforeseen 'fires'--by careful, professional planning. Vital and hard to come by dollars are saved because problems are anticipated and avoided. It is a tool that can minimize the annoying and frustrating 'paper mill' associated with complex systems by cutting down on data requirements and eliminating duplication."[6]

It has not been possible to treat the subject of Air Force System Engineering Management exhaustively in this paper. System engineering as such has been used on a wide scale by both industry and the government. In the government, the Air Force Ballistic Systems Division and the MITRE Corp. (a not-for-profit) both have extensive experience and background in this subject. This background and experience, plus other concerted studies, have evolved the procedural technique described herein. AFSCM 375-5 is therefore essentially the composite experience of both industry and government and is expected to result in systems that meet the stringent Air Force requirements of time, cost and performance.

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2. Air Force Regulations AFR 375-1, 375-2, 375-3, 375-4, 375-5, "System Management," and the supplementary Air Force Systems Command regulations and manuals.

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5. General B. Schriever, Commander, AF Systems Command; addressing the Air Force-Industry Data Management Symposium, Beverly Hills, Calif., October 1965, GSE Magazine, Fourth Quarter, 1965.

6. Lt. Gen. W. Austin Davis, Vice Commander, AF Systems Command, December 1965 Systems Command Newsreview, Vol. 9, No. 12.

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13. ABSTRACT

This paper highlights the organization of a creative technology--System Engineering Management. A new Air Force Systems Command Manual describes the importance of TOTAL SYSTEM DESIGN, in which it is recognized that the successful design of a complex military system is fundamentally dependent upon the complementary interplay between all the technical/managerial/support specialists and disciplies. The procedures summarized herein are the engineering management standard for all future system acquisition programs and projects by the Air Force.

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Contractor Engineering Management						
Total Systems Design						
System Design Techniques						

INSTRUCTIONS

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